AMSAT™

NEWSLETTER

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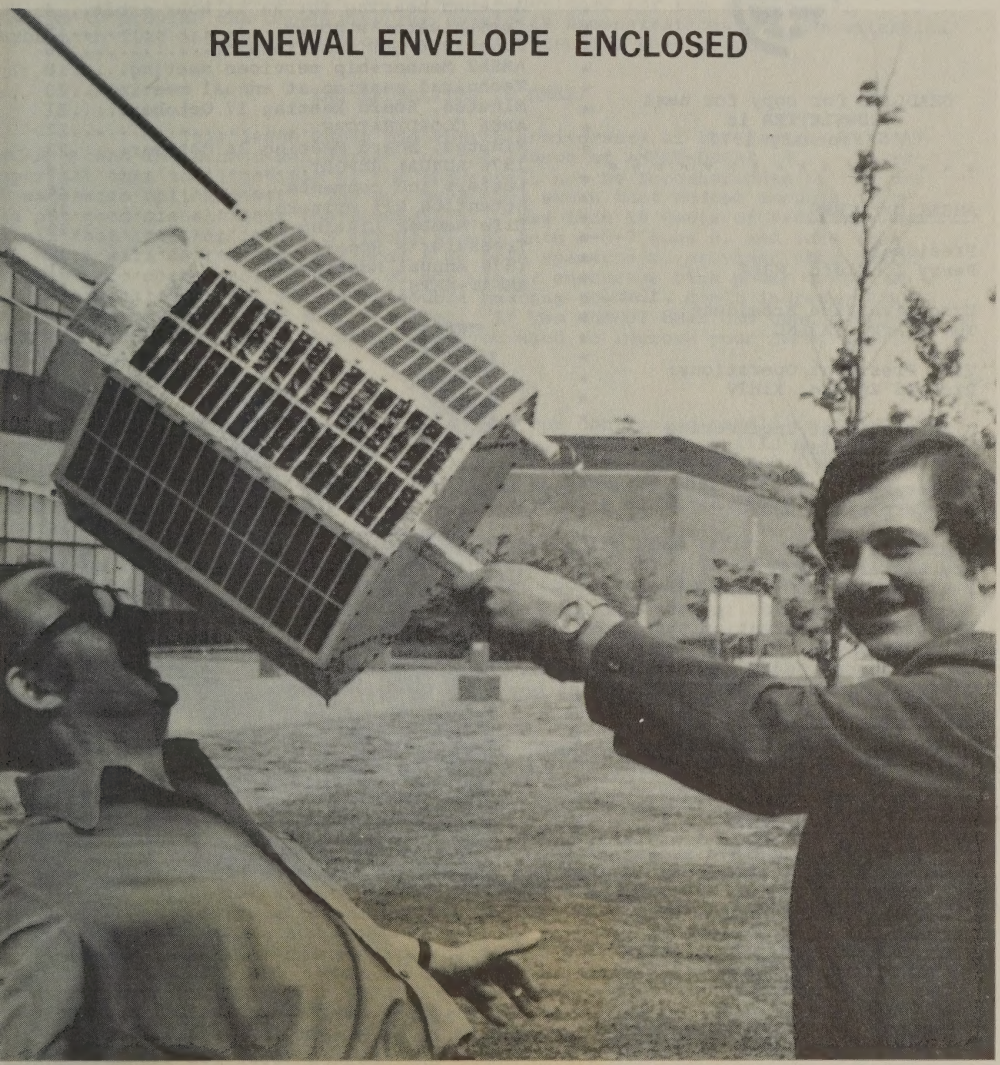
RENEWAL ENVELOPE ENCLOSED



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COVER CREDIT

8P6DR communicating with G3IOR using AMSAT -OSCAR 7.
photo G3ZCZ

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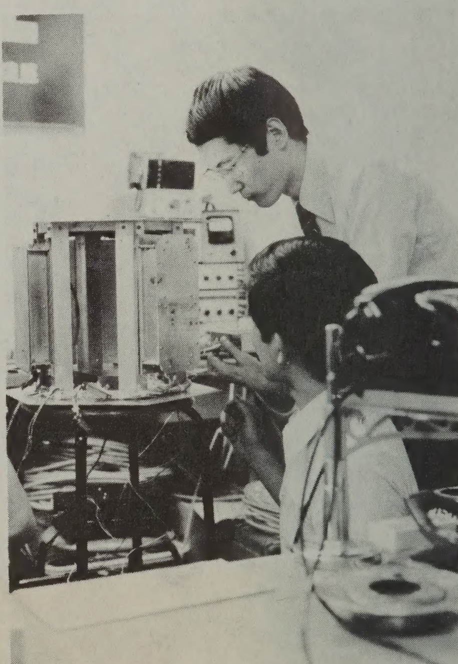


Japan AMSAT Association members prepare their OSCAR satellite engineering model for testing.

TWO SATELLITES TO COME

AMSAT is currently building two spacecraft. The Phase III spacecraft has a launch date in December 1979. The European Space Agency(ESA) has agreed to provide a place on the second ARIANE launch vehicle flight. This will be the first non US launch of an AMSAT spacecraft. AMSAT is also working on a Phase II spacecraft. This spacecraft is known as A-O-D, and is destined for launch in late 1977. It is a joint venture of AMSAT, Project OSCAR and JAMSAT. It marks the first time that Project OSCAR and AMSAT have cooperated on building flight hardware. A-O-D will contain two transponders: a 145/29 MHz built by AMSAT in Washington DC, similar to the one flown on AMSAT-OSCAR 6, and a 145/435 MHz transponder being built by the Japanese AMSAT Association. A prototype of this transponder has been tested on Mount Fuji in Japan with promising results. One unique aspect of that transponder is that it uses power FETs in the power amplifier stages.

The frequencies to be used by A-O-D are as follows;

UPLINK (MHz)	DOWNLINK (MHz)	BEACON (MHz)
145.85-145.95	29.4-29.5	29.4
145.9-145.95	435.1-435.15	435.095

NOTE that the 145/435 transponder bandwidth may be slightly narrower than shown, and incorporates passband inversion(cf. A-O-7 Mode B).

This satellite is primarily designed for the educational program to provide the capability for satellite demonstrations and communication through to 1980 and the launch of the first Phase III spacecraft.

TWO SATELLITES IN ORBIT

This issue marks the fourth anniversary of the launch of AMSAT-OSCAR 6 and the second anniversary of the launch of AMSAT-OSCAR 7 . It is important that the lifetimes of the spacecraft not be foreshortened by the use of excessive uplink power. The qrp days have shown that modest amounts of rf can put good signals into the spacecraft. Less than 10 Watts of radiated power is all that it takes to put a strong signal into A-O-7 Mode B, and less than 100 Watts will do the same for Mode A on both spacecraft, provided that there are few qro operators. Please, do not use or encourage high power operation via the satellites. If you have trouble hearing yourself, don't increase your uplink power, but examine your receiver. If you CANNOT hear the beacon signals from AMSAT-OSCAR 6 on an overhead pass you need to improve your receiving capabilities.

QSL BUREAU

AMSAT maintains a QSL bureau for confirming satellite qso's. Any US or VE member or satellite user can maintain a few sase's on file and will receive cards confirming contacts with other satellite users. Any AMSAT member can also send out cards confirming satellite contacts by means of the AMSAT bureau. There is no cost for cards destined to W, K or VE stations, and a flat rate of 6¢ a card to all other countries.

I recently had a chance to peruse the dead cards(cards at the bureau for which the recipient has no envelopes on file). There are DX cards, rare states and special event stations cards. Some people nearly have enough cards for an OSCAR or Satellite 1000 award waiting for them at the bureau. These cards will have to be returned to the senders or destroyed in the near future. If you use the satellites but do not have an sase on file at the AMSAT QSL BUREAU, send at least one in today. If you are an AMSAT member you can also send out cards at the same time. You may be pleasantly suprised as to what you will find in your first returned sase. The address is -

AMSAT QSL BUREAU, Dennis Grindrod,WA1EHF, Manager, 564 Stillman St., Bridgeport, Conn., 06608.

SPONSOR A SOLAR CELL

Building two spacecraft is an expensive business. The cost of the solar cells alone is estimated to be in the tens of thousands of dollars. AMSAT just does not have that kind of money, so those funds have to be raised somehow. When a terrestrial fm repeater is put on the air, the users normally contribute to the cost of establishing and maintaining the repeater in operation.

Spaceborne transponders are many times more expensive than terrestrial repeaters (A-O-7 cost us $60,000; an identical commercially built unit could have cost $2,000,000). AMSAT is about to begin a fund-raising campaign. If you can contribute at least $10.00 , help in administering the program or have any constructive ideas on the subject, contact Tom Clark, WA3LND at AMSAT, or send in your tax deductible sponsoring donation. All solar cell sponsors will receive a certificate attesting to their status.

Joe Kasser, G3ZCZ

ANTENNA BEAMING FOR AN ELEVEN HOUR ELLIPTICAL POLAR ORBIT

By Otmar K. Popp, DL3SX

Part I: The Effects of An Elliptical Orbit

Elliptical orbits differ from the well known circular orbits by two main principles:

1. The altitude is variable, depending on the position of the satellite, and as a consequence communication range differs from minute to minute;

2. The speed of the satellite along the track is variable, and so the position itself depends on the time which has passed since perigee (or since crossing the equator).

Independent from the elliptical orbit, but as a consequence of the long periods, the rotation of the earth becomes much more significant than with the orbits of AMSAT-OSCAR 6 or 7. During a pass of 20 minutes, the earth turns only 5 degrees towards the East; but 10 hours (the time that the satellite takes to travel from equator to equator) means that the rotation of the earth is about 150 degrees .

Of course, as yet we don't know the final orbital conditions, but we should prepare so that we can get our antennas beamed in the proper direction for that day when the satellite is made available for use. We should also become interested in space problems at least to an extent such that we can understand how the Phase III spacecraft travels around the world. The effects of an elliptical orbit are somewhat strange to us, but probably exciting.

1. A Typical Orbit

A good standard assumption is an equatorial crossing at a longitude of zero degrees, at 0:00 gmt. The points overflown by the satellite as well as the steady changes in altitude and time are shown by Figure 1. The basic orbit is suggested to be that of AMSAT-OSCAR 7. The time is given in hours after crossing equator as this is familiar with the circular orbits.

The data to be read from Figure 1 holds irrespective of our own surface location, but if we look for the elevation angles and directions, or for the time of possible communication, we must take it into account.

2. Elevation Angles for Selected Locations

An elliptical orbit track means that the communication capabilities are not the same in different locations, and everyone should compute the data for his own geographic position. Figure 2 shows the elevation angles and the duration of possible communications for selected locations for the "first day" of our model orbit, i.e. Orbit "1" and "2", and for the first part of Orbit "3". Some days later these conditions will have changed and will be true for other points on the earth at an equal latitude.

3. How to Rotate the Antenna

During Orbit "1" or "2", a station in New York, or Munich for example, will have two periods of satellite availability each day. The antenna directions required are shown by Figure 3.

(continued on Page 6)

CLASSIFIED

These messages are published as a service to members at no cost on a space available basis. Deadline for next issue is 1 February 1977.

- -

LSB mod kit for Echo II., $12.00pp. G. Simmons, WA1POJ, 46 Broad St, Warren, RI., 02885 (401) 245-4075.

Figure 1. The 11 hour orbit

The positions of the sub-satellite-point SSP (γ_p, φ_p) in hours after equatorial crossing, and the height of the spacecraft in thousands of miles.

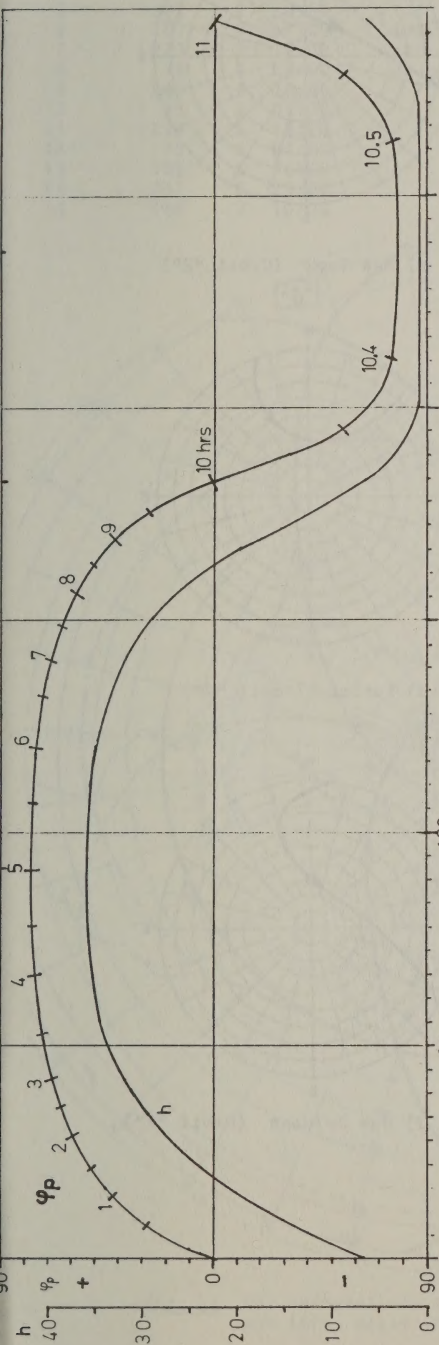
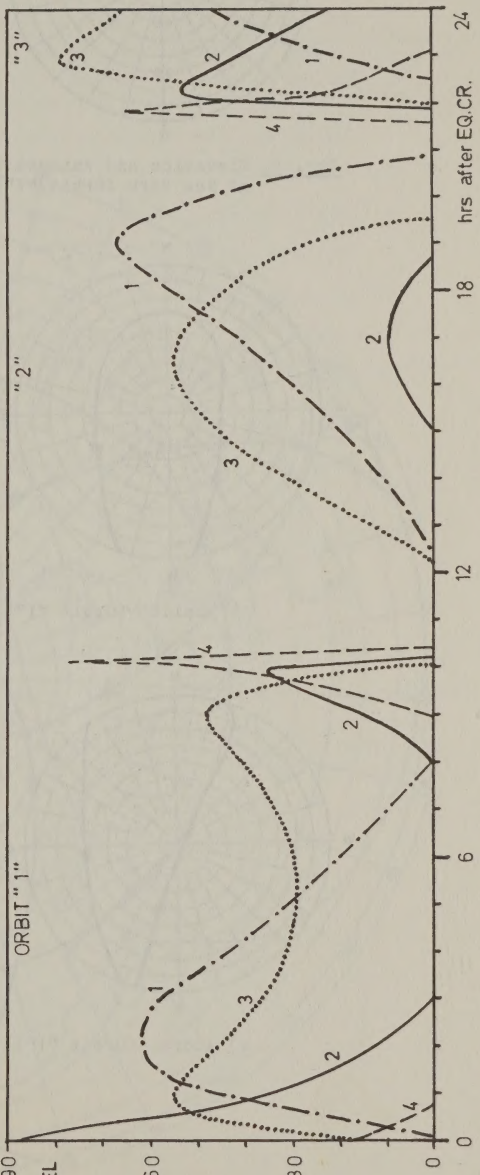


Figure 2. Elevation angles, and time available for contacts,

1. New York
2. Accra
3. Munich
4. Johannesburg



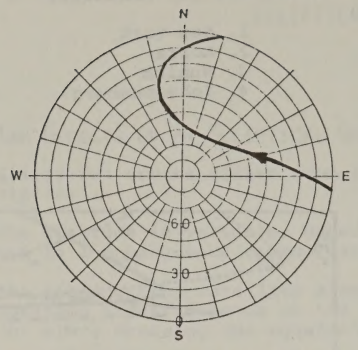
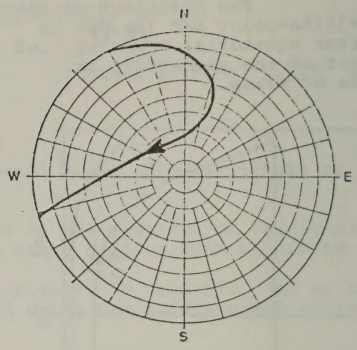
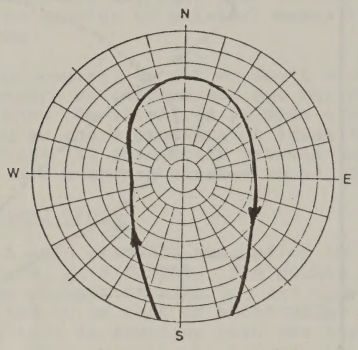


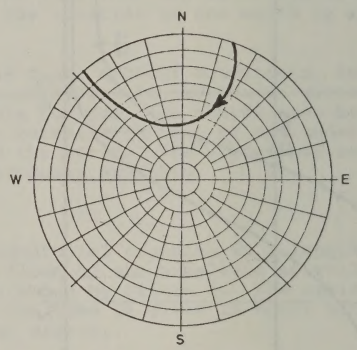
Fig. 3: Elevation and Azimuth from
a) New York (Orbit "1")



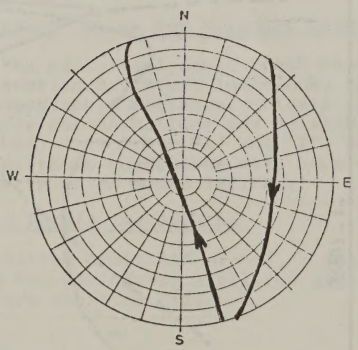
b) New York (Orbit "2")



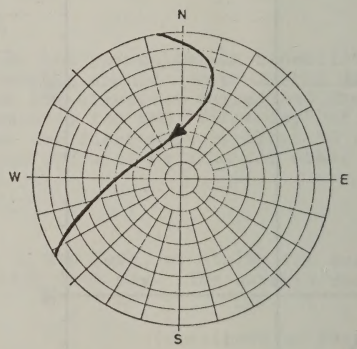
c) Munich (Orbit "1")



d) Munich (Orbit "2")



e) Accra (Orbit "1")



f) New Orleans (Orbit "2")

4. Parts of the World Which May Be Reached Via the Satellite

ORBIT NR	EQUATOR CROSSING Deg W	DAY	GMT
1	0	1	00:00
2	165	1	11:00
3	331	1	22:00
4	136	2	09:00
5	302	2	20:00
6	107	3	07:00
7	273	3	18:00
8	78	4	05:00
9	243	4	16:00
10	49	5	03:00
11	214	5	14:00
12	20	6	01:00
13	185	6	12:00
14	351	6	23:00
15	156	7	10:00

For any particular ground station in or near the Northern Hemisphere, nearly the whole (northern) hemisphere is in range when the satellite is at or near the apogee, but even when it is crossing the equator, the communication ranges are much greater than today's satellites allow. Figure 4 also shows the sub-satellite tracks of the orbits "1", "2", and "9". In an 11 hour orbit, the track "sambas" around the hemisphere, stepping about 29 degrees towards the East with each couple of orbits.

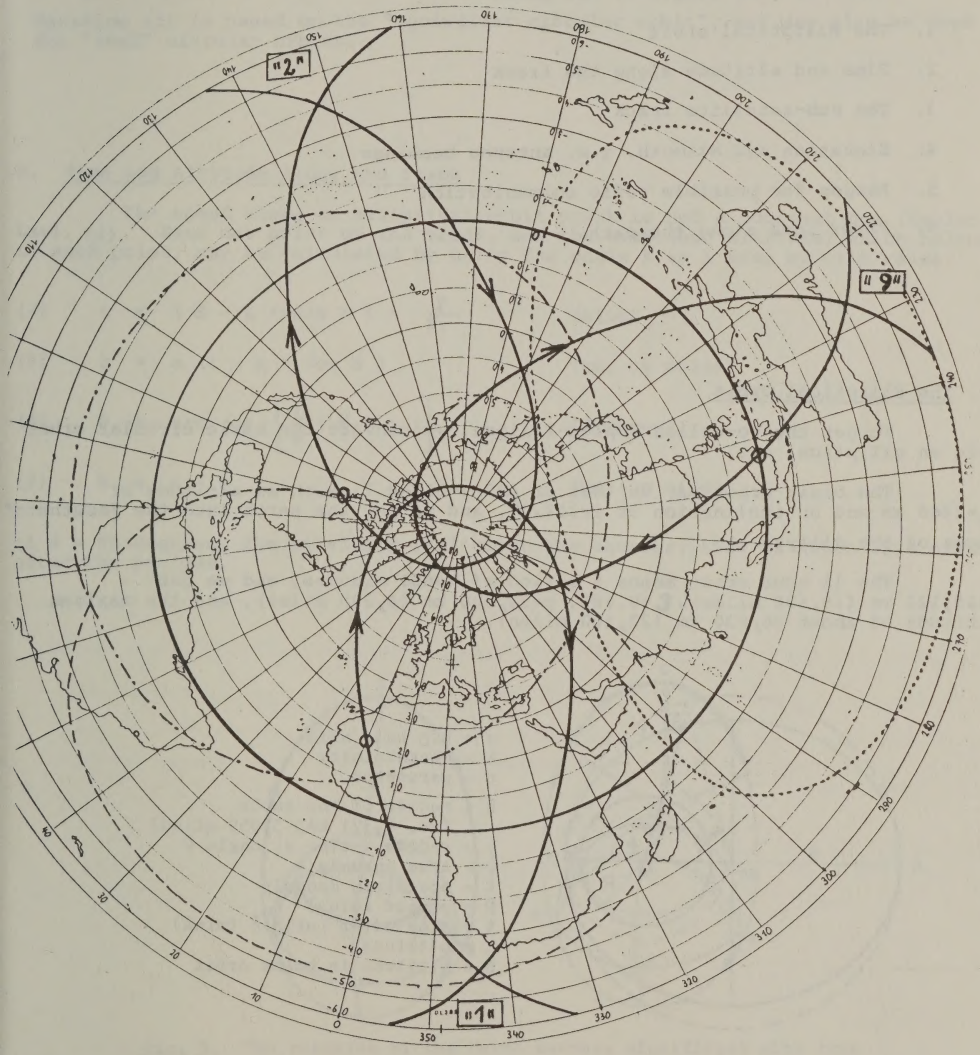


Fig. 4: The subsatellite tracks of Orbit "1", "2", and "9", and three selected areas of communication

PART II: HOW TO GET THE DATA

After launch, when the satellite orbit has been determined we shall get actual orbital data. We then may use the already published helpful information in the same way (1), (3) as we did for satellites in circular orbits. The greater distances will call for sharply beamed antennas, so we should calculate the elevation angles and directions individually with respect to our location. For doing so we may use a programmable pocket size calculator, and those like the HP-67 or T.I. SR-52 solve the problem easily. But even the smaller ones do a good job.

For anyone who intends to start in orbital calculations, this is a summary of equations needed. Although we must run a step by step procedure -- of course there are other methods possible -- it is easily done. And why should we not play an "OSCAR Track Game" even before the spacecraft has been launched. Activate your microprocessor controlled "station computer".

These are the stages of the game:

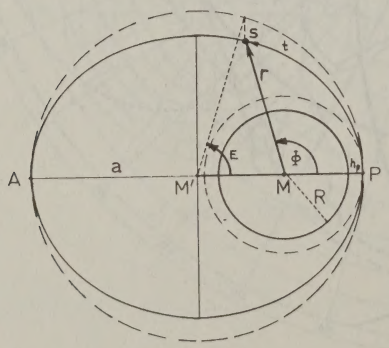
1. The elliptical orbit
2. Time and altitude along the track
3. The sub-satellite track
4. Elevation and azimuth, i.e. antenna beamings
5. Ranges for possible radio communication
6. Power loss along the path

1. The Elliptical Orbit

To get the so-called Kepler-Ellipse, we convert the basic circular orbit into an elliptical one.

The basic orbit may be that of AMSAT-OSCAR 7, with an altitude of h_p=1460 km and an inclination of i=101,7°, and we put the earth into the "southern" focus of the ellipse.

The 11 hour orbit means a period of P=660 minutes, and we get a=25,120 km (15,608 miles), ε=0,688, p=13,200 km (8,200 miles), and the maximum altitude of about 36,030 km (22,400 miles).



a = big half axis
ε = eccentricity
p = parameter
R = radius of the earth (av. 6,371 km; 3,959 miles)
r = radius vector at angle Φ
Φ = true anomaly
E = eccentric anomaly
P = period (mins)
t = time after perigee (mins)
h = altitude
h_p = altitude in basic orbit

(1) $a \approx \sqrt[3]{P^2 \cdot 36{,}4085 \cdot 10^6}$ ----------(km)

(2) $\varepsilon = 1 - \frac{h_p + R}{a}$

(3) $p = a\,(1 - \varepsilon^2)$

The maximum altitude is $\overline{MA} - R = a(1+\varepsilon) - R$.

If you prefer miles instead of kilometers (1 mile = 1,609344 km), use

(1a) $a \approx \sqrt[3]{P^2 \cdot 8{,}7349 \cdot 10^6}$ (miles).

Equation (1) is based on the "equivalent circular orbit", and may also be used for "real" circular orbits.

2. Time and Altitude Along the Track

The speed along an elliptical orbit track is not a constant one (Kepler's Law), (4). Each one point of the track, and the time (and altitude) which belongs to each point, may be calculated by using the angle E as a step by step value:

(4) $t = (E - \varepsilon \cdot \sin E) \cdot \frac{P}{2\pi}$ (mins)

(5) $r = a\,(1 - \varepsilon \cdot \cos E)$ (km, or miles)

(6) $\Phi = \arccos\left[\frac{1}{\varepsilon}\left(\frac{p}{r} - 1\right)\right]$ (degrees)

(7) $h = r - R$ (km, or miles)

At $\Phi = 90$ degrees, the satellite will cross the equator; this is about 32,8 minutes after the perigee.

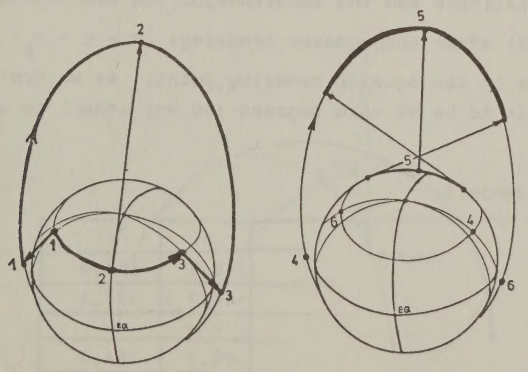
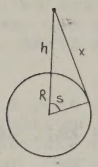


Fig. 5: The rotation of the Earth becomes significant with long orbit periods (elliptical orbit, schematic)
1-first equ.cr.; 2-first apogee; 3-descending equ.cr.; 4-second equ.cr.; 5-second apogee; 6-desc.equ.cr.

From these data we may derive others, well known with AMSAT-OSCAR-7:



max. distance from the surface of the earth:

(8) $x = \sqrt{r^2 - R^2}$ (km, or miles)

radius of max. range:

(9a) $s = \arctan \frac{x}{R}$ (degrees) or

(9b) $s = 111{,}1989 \cdot \arctan \frac{x}{R}$ (km)

when crossing the equator, s is about 61 degrees. One (1) degree means about 111,1989 km (or 69,10 miles) on the surface of the earth (based on the average radius of 6371 km).

Now we may fill in Table 1 (km used):

E	t	Φ	r	h	x	s/d	s/km
0	0	0	7,831	1,460	4,550	35	3,045
10	5,8	23	8,090	1,720	4,980	38	4,230
20	12	45	8,870	2,500	6,180	44	4,900
.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.
180	330	180	42,400	36,050	41,940	81	9,045

3. The Sub-Satellite Track

The standard equations for the projection of the track onto the surface of the earth may be used, this time implementing the angle Φ (3):

(10) $\varphi_\rho = \arcsin \left\{ \sin i \cdot (-\cos \Phi) \right\}$

(11a) $\gamma_\rho = \gamma_\chi + \frac{T}{4} + \left\{ \arccos (\sin \Phi : \cos \varphi_\rho) \right\}$ if $\varphi_\rho \geq 0$

(11b) $\gamma_\rho = \gamma_\chi + \frac{T}{4} + \left\{ \arccos (-\sin \Phi : \cos \varphi_\rho) \right\} + 180$ if $\varphi_\rho < 0$

φ_ρ and γ_ρ are the latitude and the longitude of the sub-satellite point (SSP); T is the time (mins) after the equator crossing: $T = t - t_o$; $t_o = 32{,}8$ min.

γ_χ is the longitude of the equator crossing point. As we don't know its final values, we assume it to be at zero degrees (or any other) to see what the track will look like.

Now we may extend Table 1:

E		ρ	γ_ρ
0		-78,3	261,8
10		-64,3	327,3
.		.	.
180		78,3	164,3
.		.	.
360		-78,3	66,8

This has been the first orbit; repeat for the following orbits using γ_X = 165 degrees and so on.

Note: With E between 180 and 360 degrees, use $-\Phi$ instead of Φ (with E = 350 degrees for example, Φ would be 23,8 instead of 336,2 degrees).

Until this point, all data is independent of our own location.

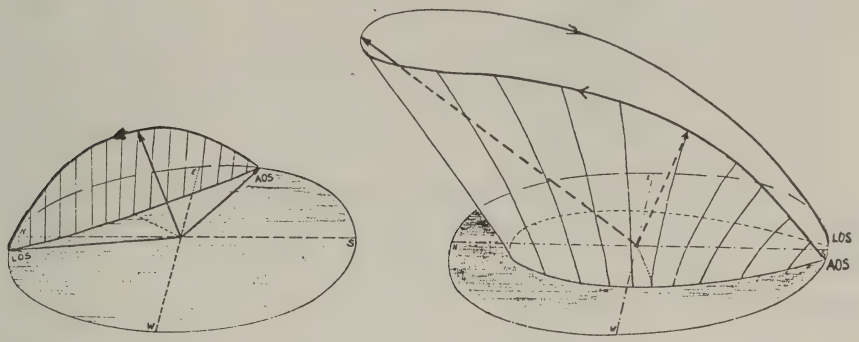


Fig. 6: A typical pass in a circular orbit, and what an elliptical orbit track might look like

4. Elevation Angle and Azimuth

Use the formulae you already know (3), and complete Table 1.

A negative value of elevation means that the satellite is below the horizon. Take care of those positions where you must exceed 360 degrees longitude, or when you go "north of the North Pole".

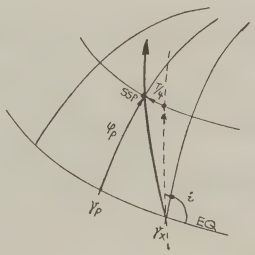
(12) $s' = \arccos \left\{ \sin \varphi_\rho \cdot \sin \varphi_Q + \cos \varphi_\rho \cdot \cos \varphi_Q \cdot \cos (\gamma_\rho - \gamma_Q) \right\}$

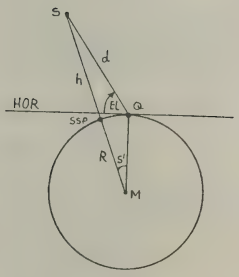
(13) $EL = \arctan \dfrac{\cos s' - R/r}{\sin s'}$

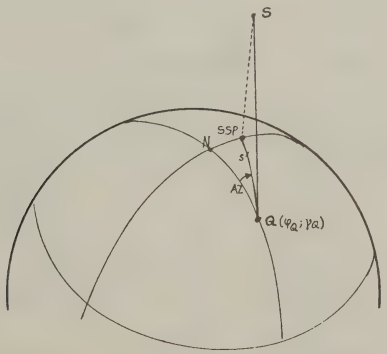
(14) $\beta = \arccos \dfrac{(\sin \varphi_\rho - \sin \varphi_Q) \cdot \cos s'}{\cos \varphi_Q \cdot \sin s'}$

(15a) $AZ = \beta$ if $(\gamma_\rho - \gamma_Q)$ <0 or >180

(15b) $AZ = 360 - \beta$ if $(\gamma_\rho - \gamma_Q)$ >0 and <180







Complete Table 1:

E	New York	
	EL	AZ
.	.	.
60	6	93
.	.	.
90	45	72
.	.	.
120	62	27
.	.	.
150	51	349

At locations East of Greenwich, equations (15-1) should be used:

(15-1a) $AZ = \beta$ if $-180 < (\gamma_\rho - \gamma_Q) < 0$

(15-1b) $AZ = 360 - \beta$ if $(\gamma_\rho - \gamma_Q) < -180$ or > 0.

γ_Q is always used as degrees West.

5. Ranges for possible Radio Communication

To find out which parts of the world may be contacted via the satellite at any time, use the data already calculated, and suppose the spacecraft to be at φ_ρ = 78.3 degrees North, γ_ρ = 329 degrees West. This is the apogee point of orbit "2". Table 1 shows s = 81 degrees.

From this position the satellite "sees" an area defined by reference (1).

(16) $N = \arcsin(\cos\delta \cdot \cos\varphi_\rho \cdot \sin s + \sin\varphi_\rho \cdot \cos s)$ degrees North

(17) $L = \arcsin(\sin s \cdot \sin\delta : \cos N)$

(18a) $W_1 = \gamma_\rho + L$ degrees West

(18b) $W_2 = \gamma_\rho - L$

N < 0 means southern latitude.

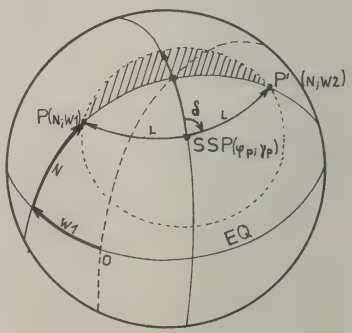
At least at δ = 0 degrees (i.e. North), you may go beyond the North Pole. In this case, SIN in (17) goes back to below 90 degrees and you will get an incorrect value for the longitude. Beyond the North Pole, long. 40 deg for example becomes long. 220 degrees.

If you must extend the North Pole, i.e. (φ_ρ + s) > 90 degrees (shaded area), use (17-1) instead of (17):

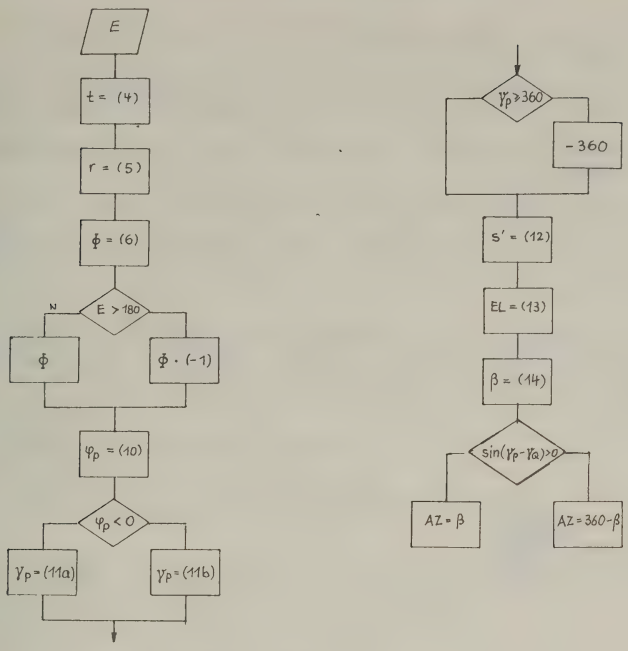
(17-1a) $L = \arccos(\sin\delta \cdot \sin\rho \cdot \cos\varphi_\rho - \cos\delta \cdot \cos\rho)$

(17-1b) $\rho = \arcsin(\sin\delta \cdot \cos\varphi_\rho : \cos N)$

	N	W1	W2
0	20	149	149
15	20	134	165
30	19	118	181
45	17	102	196
60	14	87	211
75	11	72	226
90	8	58	241
105	5	43	256
120	3	28	270
135	0	14	285
150	-2	359	300
165	-3	344	314
180	-3	329	329



An alogorithm for solving the problem



6. Power Loss along the Path

Finally we want to know the power needed to access the satellite. The distance to the spacecraft is

$$(19) \qquad d = \frac{r \cdot \sin s'}{\cos EL}$$

and the path loss in free space in dB, with G as the gain of the antenna compared with a half-wave dipole, is (ground losses at low elevation angles not taken into account)

$$(20) \qquad L = 32.5 + 20 \cdot \log (f/MHz) + 20 \cdot \log (d/km) - G$$

If we transmit with a transmitter power of P_t (watts), the satellite will receive

$$(21) \qquad P_r = P_t \cdot \sqrt[10]{10^{-L}} \qquad \text{(watts)}$$

(compute $P_t \cdot$ INV LOG $\frac{-L}{10}$, or $P_t \cdot 10^x$, $x = \frac{-L}{10}$)

As a reference we may look at AMSAT-OSCAR 7. With this spacecraft we know that at moderate elevation angles and under "normal" loading, 2 to 5 watts at a 10 element antenna give a good cw signal back from the satellite (mode B). In addition, the Phase III spacecraft will be fitted with a quadrifilar antenna, giving true circular polarization and some 10 dB of gain.

Part III: The Changes in an Orbital Track with Time

Average calculations for orbital predictions normally include many simplifications, namely:

1. The satellite is assumed to follow the Kepler-Ellipse;
2. The Earth is assumed to be a sphere.

In doing so, calculations become easy, and the error introduced is very small.

3. Instantaneous, and small periodical changes in track parameters which cancel with time are neglected;

4. The interactions between the satellite and the atmosphere, the solar light pressure, and other bodies, are neglected in short term predictions.

But at least two sources of error add from orbit to orbit, and they should be taken into account, namely;

1. Neither the Earth nor the sun are standing still, and

2. The orbit of a satellite depends on the relationship between masses.

1. Solar Day and Sidereal Day

A day, or 24 hours, we call the time which passes from midnight to midnight, or what is the same, from one high noon to the next one. So we think that the earth turns around its axis once a day, fulfilling a closed turn of 360 degrees. But this is relative to the direction to the sun.

Assume the earth to be standing at position 1. At high noon we get a straight line from our location (A) to the sun (☉), and to a star (*) exactly behind the sun.

One day later, the earth has moved on its way around the sun to position 2, and our location has been shifted to A'. Again the sun is standing highest above the horizon, But the "true 360" was completed at B.

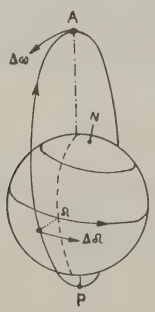
The satellite (s) nearly holds its track, and the earth rotates below the orbit. This means that the orbital track, or the equator crossing point, seems to drift to the West day by day.

The period between A and B is called a Sidereal Day, that between A and A', a Solar Day (more precisely, an average solar day). The difference in time between B and A' is $3^{min}\ 56^{sec}$ per day, equivalent to an angle of 0.98 degrees.

2. Interactions between the Earth and the Satellite

The earth is an ellipsoid, not a sphere. The concentration of mass at the equator pulls the satellite towards the equator, but the spacecraft reacts to maintain in the orbit. This results in a drift opposite the moving direction, the so-called precession of the nodes (Δ♋). With an inclination of 101°, the precession tends towards the East. Together with the difference between solar and sidereal day, the following equator crossing point will be approximately 165.44 degrees west of the preceding one.

(Note: AMSAT-OSCAR 7 runs in a sun synchronous orbit, i.e. these two effects compensate each other.)



Another consequence is the drift of the apside line A-P, i.e. the perigee point moves 'against the track' (Δω). This means that after some 3 years or so, the apogee will hang over the equator if it originally was positioned over the North Pole. This itself is a predictive calculation, and no great accuracy should be expected.

(Continued on page 15)

COMMUNICATORS NOTES

Effective October 3, 1976, all GMT Sunday descending node (southbound) passes of AMSAT-OSCAR-6 will be considered as ON passes. The transponder will be turned on by AMSAT telecommand stations whenever possible so these orbits can be used for two-way communications. The reason for adding these additional passes is because the satellite's orbit is such that A-O-6 is in total sunlight according to recent tracking data. Our telemetry from A-O-6 indicates that the temperature on board is still rising and is almost at a peak which would confirm the data. Because of this it is necessary to keep the transponder on for additional orbits to help keep the battery from overcharging and thus overheating. Even though the satellite will be in total sunlight for a number of months to come it can't be left on all the time since the solar arrays can't provide all the power required to run the transponder. The battery must provide the balance of the power required and can't do this if it is not allowed to be recharged on a regular basis. This is the reason for the scheduled OFF days.

The new schedule for AMSAT-OSCAR-6 is: The transponder will be turned ON for two-way communications by users on all ascending node passes on Mondays, Thursdays and Saturdays and for all descending node passes on Sundays, GMT. This schedule of ON orbits will remain in effect until further notice. If the battery voltage drops below a certain point (a telemetry channel 3A count of 52) the AMSAT telecommand stations have been instructed to turn the transponder off immediately.

AMSAT-OSCAR 6 QRP DAYS

A-O-6 will be on for special QRP Tests on GMT days of Jan. 5, Jan. 14, Feb. 2 and Feb. 16, all orbits. (These are Wednesdays)

Stations should run no more than 10 Watts ERP.

Send all results to AMSAT.

A-O-7 will be commanded to Mode B during these normally Mode A days so as not to cause confusion, especially during the March orbits when the two satellites are within minutes of each other.

MONDAY IS QRP DAY FOR AMSAT-OSCAR 7 MODE B

Effective 1 October 1976, all mode B orbits that fall on Mondays (GMT) will be designated as QRP orbits. The success of the three day tests last June has prompted the establishment of these QRP days. All communicators are asked to reduce their uplink radiated power to about 10 Watts on these Mondays and any other mode B day that they care to operate. The use of low power is the method that can ensure the continued operation of the AMSAT-OSCAR spacecraft until such time as replacements are available.

Note that AMSAT-OSCAR 6 has outlived its design time, and the only way to keep it operational is to keep it working without putting any strain on the power circuits, i.e., the batteries.

The maximum erp. for AMSAT-OSCAR 7 is 100 Watts. If anyone cannot hear his downlink when using 100 Watts of radiated uplink power, he needs a new receiver NOT INCREASED UPLINK POWER.

(continued from page 14)

REFERENCES

(1) An OSCAR Angle Nomogram, AMSAT Newsletter, 4/1973
by Roy Gould, W5PAG.

(2) Getting Started in Satellite Communications, AMSAT Newsletter, 2/1974
by Ray Soifer K2QBW/W2RS.

(3) Individualized AZ/EL Coordinates in Minutes, AMSAT Newsletter, 1/1976
by Earl Skelton WA3THD.

(4) Some Numerical Calculations For The Phase III Spacecraft Orbit, AMSAT Newsletter, 3/1976 by Yasuo Nakamura JA2WO.

JUNE 1976 QRP TEST RESULTS

Edited by John Shaw, WB4HQE

It has been a number of months since the June 76 Mode B QRP Test was conducted and just a few months since the start of the regular QRP Mode B Mondays. If you participated in the 3-day June test then you probably know why the QRP days are being scheduled on a regular basis. A number of the QRP test participants took the time to send in their results and these results were so impressive that they are being presented here along with some very interesting comments. First the results:

CALL	ERP	QSO's	Stns	Cntys	States	US Call Areas
DJ2RE	8-10	29	25	13	1	1
DU6EG	1	1	--	--	-	-
G3CYY	10	27	24	11	2	1
G3ZCZ/W3	1-10	4	4	1	3	2
GD3IOR	2-10	65	54	13	7	6
GI3JLA	10	70	--	12	9	7
JA8WEU	10	16	10	2	-	-
K1HTV	1-10	33	31	8	14	7
OE1VKW	10	4	4	3	-	-
OK3CDI	2-10	79	39	14	-	-
PAØJOZ		22	21	12	-	2
SP9EGM	10	40	29	12	-	-
TU2EF (SWL)	--	--	17	8	-	-
W2EUO	10	13	--	-	7	-
W2GN	10	53	41	6	-	10
W4WQZ	3	13	10	-	7	5
W6CG	8	45	29	2	16	9
W8DX	10	40	33	6	15	9
W9DOR	10	29	26	6	14	-
WØHSK	10	8	7	1	7	6
WA4NKN	10	28	13	2	-	-
WB4HQE	1-10	56	39	6	21	9
OH SWL (Birger Lindholm)	--	--	62	17	5	3

From the above results and from the following enthusiastic comments reported to AMSAT, it should be quite obvious that QRP communications through A-O-7-B is not only possible, but desirable as well. Although most stations used CW, some used SSB for all their QSO's. Many QSO's were made with one or more stations running well below 10 Watts ERP. In the words of the participants:

- "The results really amazed me...3 watts output SSB...29 QSO's...14 States ...6 countries." W9DOR
- "...QRP TEST on Mode B. A great idea!! It was a great deal of sport and glad you had the foresight to try it out. Hope it made believers of some of the boys." W6CG
- "10 Watts ERP for A-O-7-B is strong enough to uplink." JA8WEU
- "...low erp is sufficient for high angle passes even in my noisy environment (town area)..." OE1VKW
- "WA4DYL and I contacted each other with as little as 2W ERP" WA4NKN
- "A large number of good signals were heard on each pass and there was a large geographic representation." W2EUO
- "WØEOZ acknowledged my answer to his CQ while I was unintentionally running only 50 milliwatts output (1/4 watt erp)." WB4HQE

Many who regularly use QRP on Mode B were quick to point out the superior downlinks when all stations in the passband limited their power to 10 Watts ERP. They were also disappointed by the reemergence of high power stations on the third day:

- "I normally run 10 W. erp so this test was most interesting in that the only thing which was different was that other people were using less power. I found that I was able to get through more consistently with an amazingly strong return signal." G3CYY
- "It is amazing how many more stations were worked, who like myself, are normally inaudible..." G3IOR/GD3IOR

- "During the low power test I noticed that several of the high power stations were conspicuous by their absence. Perhaps they thought that low power would not work...not many S9 signals but there were lots of Q5 signals." W9DOR
- "I was pleased to observe that the super-strong signals were mostly absent during the test." W4WQZ
- "It was nice to have as good a signal as the other stations for a couple of days." W4PID
- "Absolutely no desense or overload due to user stns was noticed in the first 2 test days...not everyone on day 3 was running QRP." WB4HQE
- "Adherence to the QRP limit was best the first night and fell off increasingly as orbit followed orbit." W4WQZ
- "By the third day, I got the impression that the EME boys had forgotten it was still QRP time...I wonder if they realize that they are costing themselves by keeping some of us out???" W4PID
- "16th June very satisfying all stations appeared interested in low power test. But I think come 18/6/76 the interest had waned and it was hard to work through normal powered SSB etc. QRM." GI3JLA

High power stations inhibit QRP operations in a number of ways:

1. They can trigger AGC circuitry which lowers input sensitivity.
2. They create unnecessary QRM and generate noise throughout the downlink passband.
3. They present an unhealthy drain on the spacecraft battery and ultimately may be responsible for a shorter operational lifespan. (This problem is particularly critical in the late fall and winter months when the spacecraft solar panels are at a bad angle with respect to the sun.)
4. Excessive power seems in part responsible for recent mode jumping.

Successful QRP operation depends greatly on the user receive link:

- "...only limitation observed was poor receiving ability of a few stations..." W2GN
- "I did learn that my receiving antenna was the weak link in the system during the QRP test..." W4WQZ

There are many reasons for recommending QRP operation on A-O-7-B. The main one is that it works...but it works well only if all users cooperate by voluntarily limiting their power. Moreover, the satellite passband can tolerate many more signals if all are QRP. Those stations who need high power to hear their return signals are best advised to QRT temporarily and improve their receive link: preamps, low-loss coax, IF pre-amplifiers, directional az-el antennas may help. If you can't hear your downlink when running under 100 watts ERP, then communication is possible only with those stations running over 100 watts ERP. Very few QSO's will result.

Most QRP participants want more QRP days:

- "I hope more QRP tests are scheduled." WØHSK
- "Let's do this again." W4WQZ
- "Please institute QRP days on a regular basis." WB4HQE
- "I would like to see more of this operation in the future." W9DOR
- "Let's have another QRP test in six months after the success of this one gets around." W2EUO

A few participants went even further:

- "I would like to see the 10 Watt limit promoted permanently." W4PID and G3ZCZ/W3
- "My best suggestion is let's have QRP every night." WA4JID
- "My suggestion is not to hold more QRP tests, but to try to enforce a continuous QRP test, with an annual QRO test of a three day period." G3IOR/GD3IOR

What more can be said?

MINUTES OF THE AMSAT MEMBERSHIP SERVICES MEETING

11 October 1976

The meeting was called to order at 1020 EDT by W3OTC. It was held at the club room of the National Institutes of Health Radio Club (K3YGG). The following attended for some if not all of the time:

Robert Balcom, W3PZK	Larry Martin, W3IBO
Ed Clammer, W3UN	Ralph Mullendore, K3CWK
Robert Carpenter, W3OTC	Jerry Owen, WB4TTL
Steve Hay, K5RZU	Walt Rader, WA3DMF
William Hook, W3QBC	Roy Rosner, WB4UOX
Joe Kasser, G3ZCZ/W3	Fred Siebert, K3PNL
Perry Klein, W3PK	Earl Skelton, WA3THD
Ted Mathewson, W4FJ	Gary Tater, W3HUC

Bill Hook welcomed the group on behalf of the NIH club.

Perry Klein welcomed the group as President of AMSAT, and gave a short history of the membership growth in the 7 years of AMSAT. The past year has seen the smallest growth in recent years, to about 2600 members.

The first subject of discussion, Membership Processing, was presented by Bob Balcom. He will be faced with approximately 1100 memberships due for renewal in January. After considerable discussion, the following recommendations were made:

Newsletters to be sent by First Class to all domestic Life Members, Area Coordinators, and APO/FPO addressees.

That a trial of sending their mailing plate to expired members be made in certain cases to see if it works as an inducement to rejoin.

Each Area Coordinator to be sent the portion of the mailing list covering his area. He should use this as a reference in finding non-member users, and attempt to get them to join.

A yearly single-page set of reference orbits be prepared to be sent to all new members, except those getting the Newsletter containing the orbits.

There are certain cases where currency controls prevent overseas hams from joining AMSAT. It was recommended that means be set up to cover membership in such deserving cases.

Those present basically opposed the sale of the AMSAT mailing list except in special cases as might be approved by the Board of Directors on a case-by-case basis.

The membership application form should include the phrase "PLEASE PRINT OR TYPE".

It was recommended that Member Societies at educational institutions (as indicated by the name and address) be charged $10 dues, rather than the normal club dues of $20.

While Bob did not feel that the workload presently required splitting the Membership Department, he felt that the logical division would be between domestic and foreign membership processing.

Larry Martin reported that his portion of the membership processing job was to code the application forms as to interest area, availability to participate actively, membership in ARRL, etc. His wife, Bev, types the membership certificates and cards, and prepares the return mailing label.

The subject of AMSAT operating awards was presented first by WA3DMF. He issues QSLs for reports, etc. There was a general lack of awareness of the reporting form. The need for regular reports was stressed. Earl Skelton reported on the OSCAR and Sexigesimal awards. He has issued 105 OSCARs and 23 Sexis. There are five foreign award issuers, though they have to date issued relatively few certificates. The following recommendations were made:

1. The Newsletter should give more publicity to the awards. Each issue should include the new holders of each award, and endorsements. Earl Skelton will prepare a suitable report for the coming Newsletter.

2. Since QST no longer lists OSCAR 1000 award winners, our Newsletter Editor should contact the League to obtain this information for publication in the AMSAT Newsletter.

W3OTC discussed the subject of the benefits, attractions, and dues of Member Societies. Other than the above recommendation for clubs at educational institutions, there was no recommendation that club dues should be changed. There were the following recommendations:

1. A real effort should be made to send Member Societies interesting and useful material.

2. A mailing should be made to Member Societies enough time before Field Day to encourage them to operate FD through the satellite.

3. Each club should be able to receive a free orbit calendar on request.

The meeting adjourned for lunch at 1215. It reconvened at 1315.

There was a short discussion of the trinket business (small items for sale). The general feeling seemed to be that the present situation where a (non-Washington) ham handles sales and sends profits to AMSAT is satisfactory.

There was a short discussion of the QSL Bureau, WA1EHF not being able to attend. The following recommendations were made:

1. The address of the QSL Bureau should be prominently printed in each Newsletter.

2. WA1EHF is urged to establish a procedure whereby Bureau users can indicate if they want partially-filled envelopes sent after a certain time duration.

The major subject for the afternoon was outgoing information to members, for example the Newsletter. Joe Kasser was contacted at work by phone and participated in the discussion of the Newletter and Area Coordinators. The discussion covered Newletter format, possible contents, and the possibility of accepting advertising. There was a discussion of the possibility of reducing the load on the Editor by the appointment of Assistant Editors. There were the following recommendations:

1. Ham equipment manufacturers of equipment specifically intended for OSCAR operation should be contacted for donations. A suitable "professional card" section of the Newsletter would be a way to publicly recognize the donors. No other advertising should be accepted.

2. The Newsletter relies on contributed material, please submit it.

3. Joe Kasser is to define the duties of such assistants for which he sees the need. Later effort will be made to match people to these jobs.

4. The present page size of the Newsletter should be retained.

The subject of Area Coordinators was brought up. Joe Kasser strongly feels the need for regular reports from coordinators. The two present, W4FJ and K5RZU, agreed that reports, no more than quarterly, would be acceptable to them. As reported above, it was decided to send member lists to Coordinators. There were the following recommendations:

1. Each Area Coordinator should receive a copy of the list of "who does what in AMSAT", along with addresses and phone numbers. This should speed replies and reduce the load on Box 27.

2. There was a general feeling, not shared by G3ZCZ, that all Area Coordinators be listed in each Newsletter, even in states having more than one.

On the subject of AMSAT nets, W3UN reported on the various international, regional, and local nets. In general, he felt operation is successful. However, they have not proven particularly effective in spreading last-minute operating

instructions. He brought up the subject of a local net on WR3ABU, our 2-meter repeater. There were the following recommendations:

1. There should be a local net using WR3ABU immediately before the Tuesday evening (local time) 75-meter net. ALL local AMSAT members are urged to monitor or participate.

2. Net times should be listed in ALL Newsletters.

3. Reports of missing Newsletter, requests of Hdqs., etc., should be made in writing, not on the nets.

Joe Kasser requested a written copy of the bulletins each week.

The subject of Orbit Predictions was discussed. With the exception of the yearly, one-page sheet of reference orbits mentioned above, no changes were recommended. It was felt that W1AW should continue to send orbit predictions. Perry Klein mentioned the orbit calculators to be introduced by ARRL and Ham Radio. There was the following recommendation:

The Board of Directors should consider the matter of foreign Member Societies wishing to reproduce the Orbit Calendar for sale.

Fred Siebert reported on his handling of information requests. He averages about 10 a week, except when articles appear in magazines such as Popular Mechanics, when the load may go over 100 per week. He almost always gets out a reply within 24 hours. Perry reported that the ARRL now has a full-time person handling AMSAT information requests and the education program. He is sent requests of a more general nature. The ARRL now handles requests for supplies for HAMFEST exhibits.

The meeting adjourned shortly before 1600.

Robert J. Carpenter, W3OTC
Secretary

Technical Session Preceding 1976 AMSAT Annual Meeting

The Technical Session preceding the 1976 AMSAT Annual Meeting was held at the Employees Recreation Center of the NASA Goddard Space Flight Center, 23 October, 1976. The session was opened at 15:10 EDT by William A. Tynan, W3KMV/W3XO, who was the session organizer. About 40 persons were present.

The first talk was presented (on tape) by John Fox, WØLER, on the subject of extracting further information from OSCAR 7 telemetry. He was able to deduce spin rates and direction of the solar panels relative to the sun. From this he is able to predict available power, etc. Jan King operated the projector and answered questions.

The second talk was presented by Jim Christo, of NASA Goddard. He described a feasibility demonstration of the use of OSCAR 6 and 7 in determining the location of planes or ships in distress. The emergency locator transmitter (ELT), relayed through the satellite, allows coverage of a wide area from a relatively small number of ground stations. The tests showed a location accuracy of better than 100 miles with no corrections, and better than 2 miles using corrections for ionospheric effects. These effects were significant since the 30 MHz downlink was used.

Jan King, W3GEY, presented a talk on the present status of Phase III. The desired orbit is now established and the radiation dosage has been determined. The effect on solar cells has been determined and the necessary cover-slip thickness determined. The radio-frequency hardware is progressing nicely. A prototype of the Integrated Housekeeping Unit was shown at the Experimenters Conference last Spring. The most exciting event of the Session was Jan's announcement that AMSAT has been selected to provide the secondary payload on the Ariane flight scheduled for December 1979. This was in competition with about 80 other satellites.

(Continued on page 23)

MINUTES OF BOARD OF DIRECTORS MEETING

17 October 1976

The October 17, 1976, meeting of the AMSAT Board of Directors was held at the home of William A. Tynan, Silver Spring, Maryland. The meeting was called to order at 1445 EDT by the President, Perry Klein. The following persons were present:

Thomas A. Clark, WA3LND
Jan King, W3GEY
Perry I. Klein, W3PK
William A. Tynan, W3KMV/W3XO
Robert J. Carpenter, W3OTC

There was a short discussion of the technical session to preceed the Annual Meeting.

Policy on distribution of "official" AMSAT satellite orbit predictions was discussed. There has been a problem of conflicting published information, all claiming to be official. There is also a request for orbit information to be published by AMSAT UK. The following policies were adopted:

1. Tom Clark's predictions, as published by W6PAJ, are THE official predictions.

2. A single shipment of orbit calendars shall be made available to AMSAT UK, in the quantity they specify, for sale within UK. All proceeds to be earmarked for AMSAT UK hardware projects. These copies will be provided AMSAT UK at our production cost, plus shipping.

3. "Worldradio News" and others publishing orbits shall credit their AMSAT source.

4. W1AW is urged to use the W6PAJ Orbit Book as a source for orbit data. Cities crossing data is the same on alternate days.

5. Tom Clark is no longer in a position to produce reference-orbit-only information. Others within AMSAT are urged to produce this data, however, it must agree with the Official data to an accuracy acceptable to the Board of Directors.

Tom Clark suggested that the President present a "laundry list" of jobs needing volunteers at the Annual Meeting.

Certain recommendations of the 11 October, 1976, Membership Services Meeting were acted upon as follows:

Approved sending Newsletters by First Class to all domestic Life Members, Area Coordinators, and APO/FPO addressees.

Approved a trial of sending the mailing address plate to expired members to evaluate its effectiveness in causing them to rejoin.

Approved sending each Area Coordinator that portion of the AMSAT membership list covering his area.

Did not agree to provide a yearly page of reference orbits.

Decided that the Newsletter should carry an announcement that AMSAT donations toward the sponsorship of membership for foreign hams unable to obtain U.S. funds will be encouraged.

Noted that sale of the Membership list would probably conflict with a non-disclosure statement on the Application Form. AMSAT might agree to mail items to its members for pay in certain exceptional cases.

Postponed action on changing club dues at educational institutions in view of the difficulty in determining eligibility.

Agreed that one orbit book per year be made available free on request to member clubs.

Agreed that all Area Coordinator names and addresses should be included when listed in the Newsletter.

Endorsed a local net on 25/85 immediately before the Tuesday (local) 75-meter net (in the Washington area).

Jan King presented a status report on his recent activities in investigating a source of surplus solar cells of the type needed for Phase III. There seems to be some chance that they are a rejected lot. Jan is having some tested to try and identify their history. If they prove acceptable, enough for one Phase III craft will cost somewhat over $5000. He suggests that we buy enough for two. He has one tentative offer from an experienced company to assemble our solar panels for their out-of-pocket costs. About a one-year lead time is needed for assembly. The total cost, including cells, will run into tens of thousands of dollars.

The above discussion led into a budget discussion. Our total assets are about $54,000, of which about $25,000 are carried as Life Member reserves. With the expected income for 1977, and the carry-over from 1976, about $35,000 is available in 1977. This will not cover both a technician and engineer salary and the solar cells. A number of possible fund-raising means were discussed. One possible incentive for donations would be to issue a certificate to each donor specifying what portion of the spacecraft his donation made possible. Small donors would get a certificate for a solar cell, up to larger donors who would receive a certificate for e.g., a whole transponder.

There was a discussion of the future of ITOS launches. The present uncertain future was felt by some to be NASA-NOAA politics. This affects the priority which AMSAT should give to an interim A-O-D satellite to be launched with ITOS-I. There was a tentative agreement to hire a technician at about 16 hours a week to construct A-O-D.

Jan King reported that it seemed almost certain that we will get written ESA approval to be the secondary satellite on the 2nd Ariane test flight to be launched from French Guiana in the third quarter of 1979. This would provide a launch for Phase III.

There was a tentative decision that Perry should either be hired as a full-time employee or be asked to serve as a volunteer, not continued at a part-time rate.

With active hardware projects, there seems to be greater likelihood of success in fundraising. For example Pete Hoover has indicated a willingness to start a campaign and wants to know how much we need.

There was further discussion of the budget and employment agreements, but no final actions.

The interim satellite, A-O-D, was approved by all Board of Directors members present.

The meeting adjourned at 1905 EDT.

Respectfully submitted,

Robert J. Carpenter, W3OTC
Secretary

AMSAT AREA CO-ORDINATORS

Update to previous listings.

MASSACHUSETTS NOTE CHANGE Larry Langevin K1GXU, 42 Prospect St., Ludlow, Mass. (413)-583-3800.

SOUTH CAROLINA Robert V. Yates W4GCB. 152 Shelton Drive, Spartanburg,SC. 29302 (803)-579-1974.

Area Co-ordinators are needed in Wyoming, Nevada, Oregon, South Dakota, Arkansas,Colorado, Delaware, Minnesota, Idaho, Iowa and Missouri. If you live in one of these states and want to become an area co-ordinator,write to K1HTV, 36 Sweet Birch Drive, Meriden ,CT, 06450.

MINUTES OF BOARD OF DIRECTORS MEETING

24 OCTOBER 1976

The 24 October 1976, meeting of the AMSAT Board of Directors was called to order at 155Ø EDT by the president, Perry Klein, W3PK. The meeting took place at the residence of Richard Daniels, WA4DGU, Arlington, Virginia. The following persons were present:

Thomas A. Clark, WA3LND	William A. Tynan, W3KMV/W3XO
Charles Dorian, W3JPT	Richard Zwirko, K1HTV
William Dunkerley, WA2INB	Robert Carpenter, W3OTC
Jan King, W3GEY	Richard Daniels, WA4DGU
Perry Klein, W3PK	Roy Rosner, WB4UOX

The results of the previous evening's election of members of the Board of Directors were discussed, particularly the logistical problems associated with the election of Pat Gowen, G3IOR. Perry Klein was directed to contact Pat by telephone on Monday (25 Oct) to discuss the best means for Pat to participate in Board activities.

There was a short discussion of the turnover in AMSAT membership. It was suggested that the Membership Committee contact former members to determine the reason that they dropped out. (A double post-card with return section might be a suitable method.) It was also suggested that an effort be made to get non-member OSCAR users to join. (The Membership Services meeting suggested that this be a duty of Area Coordinators and the Membership Committee is sending each Area Coordinator the membership list for his area.)

All officers of AMSAT with the exception of President were reaffirmed without objection.

Mr. Tynan arrived at 16:3Ø.

The incoming Board reaffirmed the decision to proceed with both AMSAT-OSCAR-D and Phase III.

There was an extended discussion of the responsibilities of the job of AMSAT's paid employee and whether the job title ought to be "president" or some other title. The discussion included consideration of the probable sources of funds to meet the salary and equipment needs of AMSAT. Various means of attracting both small and large donors were discussed. There was considerable discussion of the division of the paid employee's time between AMSAT-OSCAR-D and Phase III. The agreement was that approximately equal time should be spent on the two projects, say 45% on Phase III and 40% on AMSAT-OSCAR-D. The Board agreed in principle that Perry Klein should be employed full-time, with (for the moment) the title of Engineer. The relationship between the presidency and the paid position will be settled at a future meeting.

The Treasurer requested authority to move some AMSAT funds from low-interest bank deposits to higher-interest AA and AAA bonds. This request is to be taken to the Investment Committee (W2RS, W3PK, WB4UOX) and a recommendation brought back for Board approval.

The meeting adjourned at 175Ø EDT.

Respectfully submitted,
Robert J. Carpenter, W3OTC
Secretary

(Continued from page 20)

Marty Davidoff, K2UBC/3, described orbit-ephemeris predictions for highly-elliptical orbits like the one proposed for Phase III. He had a calculator to display, and a hand-out describing the calculations.

Tom Clark, WA3LND, presented a short talk on the generation of high-accuracy orbital predictions by computer for the OSCAR 6 and 7 Orbit Book for 1977, and the means taken to eliminate the modest errors in OSCAR 7 predictions in the 1976 book.

The Technical Session was adjourned at 17:50 EDT.

FROM THE PRESIDENT'S DESK

AMSAT 1976 ANNUAL REPORT

BY PERRY I. KLEIN W3PK

AMSAT saw continued growth in membership during 1976, our eighth year of operation, from 2,366 members and member societies (Oct. 1, 1975) to 2,585 as of October 1, 1976, a growth of 9%. The current figure includes 551 life members, representing 21% of the total membership.

Summary of Activity in 1976

AMSAT-OSCAR 6 and AMSAT-OSCAR 7 continued operation throughout the year, attaining their fourth and second birthdays, respectively. Some further degradation in A-O-7's battery is apparent, which may cause the spacecraft to shut down during periods of high Mode B use. There is still no indication that either satellite is approaching end of life, however.

A number of interesting experiments were conducted with the two spacecraft during the year. The Canadian government's Communications Research Centre and NASA's Goddard Space Flight Center independently used the two OSCARs for experiments to demonstrate the feasibility of using small satellites to locate downed aircraft (emergency locator transmissions). The results were reported in a Canadian Department of Communications news release and in a NASA paper presented at the IEEE WESCON.

The U.S. Federal Communications Commission granted permission for American OSCAR users to transmit ASCII encoded signals through the two satellites. Stations were able to remotely access a computer in Canada via AMSAT-OSCAR 7, and remote data collection experiments were also conducted using ASCII code.

Experiments were conducted between researchers at the University of Arizona and the National Institutes of Health, with other stations participating, in the relaying of electrocardiograms (ECG's) via AMSAT-OSCAR 7, both in analog and digital form. Mobile-in-motion experiments were also conducted, and included the transmission of ECG's, simulating operation from an ambulance.

From the Technical University of Budapest telecommand station in Hungary, bulletin transmissions were made to simulate "broadcast" satellite operation to small home receivers using FM and SSB-with-carrier emissions.

Special low-power tests were conducted with AMSAT-OSCAR 7's 432.15-to-145.95 MHz linear transponder in which all users were asked to limit their powers to 10 watts EIRP. The results were highly successful, with many long-distance communications taking place between ground stations using EIRP's in the 1-10 watt range. These low-power tests are now scheduled two days a month on AMSAT-OSCAR 7.

During the year, the AMSAT-OSCAR 6 telecommand stations at the University of Surrey, England and the Technical University of Budapest, Hungary increased their effectiveness and progressed toward automating their stations. Telecommand stations in Australia, Canada, New Zealand and the U.S. also continued their operation.

Significant progress was made during the year on the AMSAT Phase III project, the development of a new generation of amateur satellites for near-synchronous and high-altitude elliptical orbits. A prototype computer was delivered for use in on-board spacecraft control, and telecommand and telemetry processing and formatting. Some associated software was also developed, including command decoding and Morse code telemetry encoding programs. Analyses of the Phase III elliptical orbits were completed, along with detailed studies of the radiation environment. An extensive design review was held during May, with the experimenters from Australia, Canada, Germany and the United States in attendance.

An operations conference was also held during May attended by telecommand station operators from Australia, Canada, England and the U.S. Virtually every aspect of AMSAT-OSCAR 6 and 7 operations was discussed, including experimental programs, telemetry data analysis results and telecommand procedures.

Current Activity

Work is continuing on the AMSAT Phase III spacecraft prototype. The preliminary design document has been nearly completed by the AMSAT-Deutschland group, describing the design of each subsystem and the tradeoffs involved. Work is proceeding on the 2M-to-70cm and 70cm-to-2M linear transponders and on identifying a source of suitable solar cells. Launch possibilities are also being explored for the 1979-1980 time frame. A suitable perigee kick motor has been located for use in injecting the spacecraft into its final orbit, and work is proceeding on the active attitude control system.

A second project, AMSAT-OSCAR-D (A-O-D), is also underway in preparation for a possible ITOS/NOAA launch opportunity later next year. Two transponders are under construction for this mission. One is a two-to-ten meter transponder similar to the ones now in operation in AMSAT-OSCAR 6 and 7. The second transponder is a new four-watt 2M-to-70cm linear unit developed by the Japan AMSAT Association (JAMSAT). The spacecraft structure and module housings are being fabricated by members of the Project OSCAR group in California.

The AMSAT small-terminal project is also continuing under the sponsorship of a grant from the Northern California DX Foundation. The portable OSCAR terminals under development are small enough to be carried by hand and cost about $1,000. A prototype terminal was demonstrated under battery power at the July 1 dedication of the Smithsonian Air and Space Museum in Washington, D.C., and was used to relay portions of the President's dedication address to radio amateurs throughout North America via AMSAT-OSCAR 6 and 7.

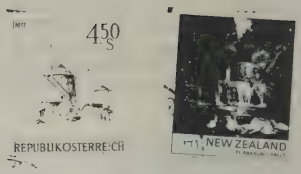
As an aid to OSCAR satellite users, the Satellabe-III OSCAR orbit plotter is now in production and available commercially. The Satellabe can also be used with meteorological satellites of the NOAA ITOS series in sun-synchronous orbits. An improved version of an AMSAT-OSCAR 6 and 7 orbit book listing all the satellite passes for the entire year 1977 has been prepared, and is expected to maintain an accuracy within a few seconds in time and fractions of a degree in longitude.

The National Science Foundation has funded a two-year project designed to produce curriculum material and disseminate information on the AMSAT-OSCAR satellites to college level educators in Astronomy, Engineering, Engineering Technology, Mathematics, and Physics. A textbook, "Using Satellites in the Classroom: A Guide for Science Educators" has been written as part of this project.

Future Projects

The AMSAT-UK group in England has under development a 15-to-10 meter linear transponder for possible flight in a future OSCAR mission, and a prototype unit is far along toward completion. In Japan, the JAMSAT group has developed an engineering model of an all-Japanese amateur spacecraft, including structure, transponder, telemetry, telecommand, power regulators, and experiment control logic microcomputer subsystems.

The Amateur Satellite Service Council (ASSC), comprised of representatives of the American Radio Relay League, Project OSCAR and AMSAT held several meetings in Washington during 1976 and expects to develop a comprehensive amateur satellite program plan for use in long-range planning and as guidance.



Gentlemen:

I wish to pay a very special recognition to John Barboe, K7VNU, Sequim, Washington, who I understand is the AMSAT AREA COORDINATOR. John received a letter from me approximately two weeks ago and took special effort to type me a two page letter and provide me various bits of AMSAT information.

I am a NOVICE ticket holder at present but have passed my GENERAL and my ADVANCE Class examinations, the ADVANCE exam I passed only last Friday. John has been the FIRST AMATEUR who I have ever contacted, who's taken the time to actually reply informatively.. ..others have written one-liners saying "I don't know" or Write the ARRL", while still others never reply at all. It is because of John's interest in helping newcomers, that I wish to let your Headquarters know that you indeed made a very wise choice in his selection.

Sincerely,
Bill Gosney,
WB7BFK

Dear Joe,

After attending the last annual AMSAT meeting at Goddard Space Flight Center on October 23, I left pondering a few points. Wonder if anyone has thought along the same lines?

AMSAT urgently needs funds to continue to construct OSCAR 8 and Phase III for launch within the next year or two. Even after all possible price breaks from the many co-operating manufacturers, the solar arrays for Phase III alone cost about $20,000. Due to launch vehicle availability for OSCAR 8, an accelerated construction pace is already demanded for this satellite at this time. This almost eliminates consideration for developing new sources of low cost space flight qualified parts and material and funds to pay for them. Just after completing OSCAR 8 , the same problems of identical or larger magnitude are knocking at the AMSAT door: Phase III is due in perhaps a years time.

I feel we should again carefully study the need for any additional satellites at this time. Although occasionally suffering from low battery voltage due to array degradation, storage capacity and sun angle effects, both spacecraft are fully functional. An effort should also be made to identify and publicize the persistent high power users of OSCAR 7 mode B. Further, all paid AMSAT members should be polled on their opinion and desires for either OSCAR 8 vs. Phase III vs. both. A 50% minimum response of the polled members being required to make it a valid survey. If the members wish any additional spacecraft at this time, a special fund drive should be started. Until a reasonable goal has been reached, no launch should be considered. If a US/NASA launch vehicle is not available at a time suitable to AMSAT, then more serious thought must be given to going piggy-back with a foreign source launch vehicle. At this stage the need for haste in any launch does not seem warranted.

It also appeared to me as if too few individuals did too much of the effort of getting OSCAR 6, 7, 8 and Phase III launched. To my knowledge only one or two people on the AMSAT staff are full time employed and salaried. The rest are all volunteers who have taken on their duties to be attended to when their spare time permits. By having to get two spacecraft ready almost simultaneously, it no longer is a spare time only effort. Either the duties should be divided amongst a greater number or we simply should admit we can't build and complete a satellite every 12 months. Our record and current status should be proof positive of our capability and achievement.

And finally, I hope that those who stood for election and were elected, did so with the full knowledge that attendance in person at AMSAT BoD is a requirement. Occasional attendance via 40 meters or telephone should not be permitted. There is too much at stake.

Everything has changed in the last few years and AMSAT and its members would do well to carefully review common priorities.

73,
Fred, K3PNL

Dear Joe,

I will be returning to the state of Hawaii on or about the 27th of December this year.

Upon arrival in Honolulu and getting settled in I will be resuming my OSCAR activities. I will be primarily interested in getting on with OSCAR 7 Mode B. I want to concentrate on trying to work into the East Coast area.

I will have available about 200 watts on 432 with up to a quad of WØEYE yagi's. On the receive side will be a pair of KLM 14's, a 1 dB pre-amp and converter for the downlink.

All this power will only be used for long haul over the horizon shots at the East Coast. I will have the option of running 10, 35, 100 or 200 watts output with 1, 2, or 5 EYE antennas.

I would like for you to list my new Hawaii address (after 1 Jan.) in the Newsletter and mention that the Hawaiian satellite award is still available.

My new Hawaiian address is:

94-1084 Lumi Street
Waipahu, Hi 96797
Phone - 808-671-5211

My wife is there now but I won't be until late December.

73's,

Stephen M. Carson
LM-61
KH6IHP

(Note QRP Test data elsewhere in this issue. -- Joe)

Dear Joe,

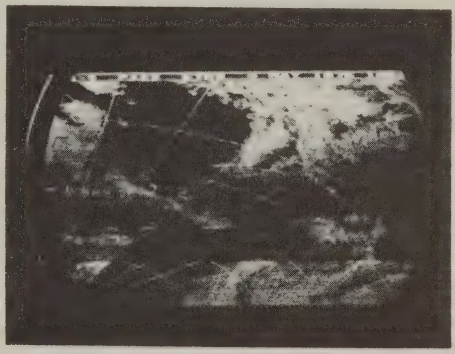
With great pleasure I received the AMSAT Newsletter yesterday, and noticed the article "Weather Picture Test Result" in Newsletter Number 3, Sept. 1976.

I was in fact wondering if you had any response to this test, as I am very interested in this subject. I have been taking weather pictures myself since 1973, and I have also heard all OSCARS, right from the start.

However, when I found out by chance via a QSO on 80 m. about this test via OSCAR 7, I of course was very thrilled. I took pictures of all three tests. I also took tape recordings of all three tests, and I did send photo's, my best ones to DLØVB.

SVERIGE 1:ÖR

Enclosed you will find the only photo left which I took on May 5, 1976, as being readable. The other two are not so good. One of the photos also contained the grey scale test card. Perhaps they are under the impression, that the photos I took, where taken direct, as I did enclose also a photo of NOAA 4, taken 20 minutes after OSCAR 7, only to show, how the photos compare.



May I make some suggestions. Please inform members direct by post of any tests with full details. When I was informed of the weather picture test, I did not know the system in use. I set up for the normal system, 4 lines/sec., and of course it was .8 sec./line. The next test I set up for .8 sec./line, and of course it was for 4 lines/second. Very depressing.

Yours faithfully,

Joost Berden, FBIS
G3RND, G6AAR-T

AMSAT-OSCAR 7 PHOTOGRAPHS
8x10 colour photo of A-O-7 over the earth $3.00pp(20IRC's). WB4VXP Allan Bridges, 4520 Bull Run NE, Kennesaw, GA.,30144; please make the cheque out to AMSAT.

Dear Joe,

Enclosed is my first report since starting 2/10 m. ops. last March. As an Englishman retired here in Denmark, I must say the Newsletter is appreciated and has given me a lot of useful info. I wish it were a monthly issue -- how about enlarging it through advertising limited to the interests of OSCAR users?

Congratulations are due to Kaz, K2ZRO for his splendid article on the Satellabe which I have made and find so useful and quite ideal for tracking. Shall be interested to hear more about the possibility of commercial production. I would like a professional job free of the minor errors I've built into mine!

I double check EQX times with my electronic calculator and now find tracking much easier.

Good luck with Phase III.

73's,
Yours sincerely,
Bob Richards,
OZ2RC

(It's available from Ham Radio Magazine. See page 30 -- Joe)

Dear Joe,

The 20th Anniversary of the Shelby, N.C. Radio Club Hamfest was a major event in the Southeast. Attendance was estimated between three and four thousand and hundreds witnessed the OSCAR/AMSAT activities.

Twelve orbits of OSCAR 6 and 7 were worked for about 40 two-way contacts; mode B was very effective. OSCAR 6 was activated for the weekend use by W4GCB/4 the Hamfest OSCAR station. Many hams and interested spectators were greeted by OSCAR user stations from many states and several foreign countries. Most of the contacts were SSB and piped over the loudspeaker. The exhibit also served as a gathering place for OSCAR users and VHF operators.

This type activity is excellent for hamfests and provides many hams with their first look at space communications.

W4GCB, Bob, WA4LBO, David, WA4OKA, Tom WA4MVI, Jim discussed various aspects of the OSCAR program with the crowd.

This was a very well done effort and a special thanks is in order to Bob Yates, W4GCB for putting it together and making it well accepted.

73,
Sincerely,

Jim Stewart, WA4MVI

Dear Joe,

Referring to the June 1976 AMSAT Newsletter -- I was very interested to read the article on the Southern Hemisphere effect. It is certainly very pronounced here in Cape Town and stations to the south of one's QTH are always much stronger than stations to the north. For example 8J1RL at the south pole is a lovely 57 on ssb but gives me QRZ when I call him -- my signal back is, to me, at least a 57, so he has a dead spot. When I work 9X5SP on ssb I cannot hear myself coming back but he copies me 57 on ssb and his signal is just readable. The same applies with me and TU2EF -- he can copy me 55 on ssb when I cannot hear myself and give him a 339. These conditions only exist on 10 metres. Mode B is 57 all the way. I agree 100% with the points raised in the article by Graham Wiseman as follows: (1), (2), (3), with no comments on the remaining points. I also have a problem peculiar to my location. When the satellite is doing a high pass 45 degrees plus elevation, and on about azimuth 340 going north, I cannot hear myself or the beacon, although other stations inform me that I am still a 57 or so. At first I thought the problems were with the antennas so tried all kinds-dipoles, turnstiles, and beams. I even added a preamp, but in all cases the problem exists. From the southern horizon to overhead and over to the northwest down to about sixty degrees elevation I am at least a 57, then I disappear completely. This problem does not occur on low passes to the east or west and I get a 55 for most of the pass. Have you any ideas as to what this could be caused by... my north western horizon is clear and I would have expected the best signals here, but no go. Other Cape Town stations do not appear to have this problem, so its unique to my QTH. I do have Table Mountain, some 3500 feet above me on my south west about two-three miles away but that should not affect me. Anyway, it's a problem I do not know how to solve until I move QTH.

Yours sincerely,

Greg Roberts ZS1BI

Dear Joe,

The ZK1DX tape is wild. I have transcribed in considerable detail what I could read from a copy K2OVS loaned me, and have enclosed it for any use and reference you wish. Also have made the following summary of stations identified on each orbit. There are some really booming signals in there, but a number

of tantalizingly uncertain identifications that may be more readable on a different tape player. I was on for Orbit 15520, and I suspect I am on the tape right at the beginning. However, the audio pitch went into zero beat in the middle of the call and I cannot be certain. There is also a good chance that someone who speaks Japanese can identify several stations that were recorded in QSO with JA8DXB.

Stations Identified on ZK1DX Tape

Orbit 15519, 51.7° 2349Z, March 7, 1976:

CW - W4MOP, K5WVX

Fone - VE3GFM

Orbit 15520, 80.4°, 0144Z, Mar.8, 1976:

CW - K5AXH, K3SUI, K7CC, W5TZX, W9UNN, W4BO, K7VNU, K7ICW, W7SFA, W4MOP, K1LJL, W8DX, WØWMP, VE7CN, VE6NS, JA8DXB

Fone - K2OVS, W7CTX, W7ZOK, W7VEW, VE3GFM, W7SFA, JA8DXB

Orbit 15521, 109.2°, 0339Z, Mar.8, 1976:

CW - W2GU/7, WØWMP, W7FF, K7CC, VE6SF, XE1RY, W9YH, W9UNN, W7SFA, W6CG

Fone - WB9RJQ, K9HDE, W7VSE, W7CTX

I am prepared to make up copies of my OSCAR 6-7 Plotter with the Ax-El and Range plot centered on any desired QTH. The plotter is approximately 8-1/2 x 11 inches and can be handled easily on the operating desk. It eliminates any need for time conversions, and AOS, LOS, Azimuths and Elevations are directly displayed for each minute of the pass. In addition, geographical areas covered by each pass are clearly indicated.

The plotter is based on a polar projection, and is consequently better suited for use in non-tropical (non-equatorial) regions, since a large portion of the useful working areas for a tropical station would fall beyond the edge of the chart.

Operators who want me to make up a plotter for their use can contact me directly at my Callbook address. The city, or latitude/longitude, of the center of the Az-El plot is required. Optionally, the Az-El plot can be omitted from the chart and a separate transparent overlay can be provided for positioning as desired. Specify if the overlay is to be for high, mid-, or low latitudes. Present artwork is for the Northern Hemisphere but am planning on providing Southern Hemisphere soon. Overlays are $1.00 each. Plotter sells for $5.00, postage paid. Prices subject to change.

73,

Dick, W2GFF

ATTENTION ALL WRITERS!

As part of the fund raising effort for Phase III, we plan to publish a large number of OSCAR satellite articles in a special satellite issue of 73 Magazine. An earlier effort, the July 1975 satellite issue of 73, netted both donations and awareness of the amateur satellite program bringing in many membership applications to AMSAT. The articles would be published in an issue of 73 coinciding with the launch of A-O-D and in the AMSAT Newsletter. In addition to the articles, the magazine will provide space for pictures and text for AMSAT to detail the fund raising programs. Now we need your help! We'll need beginner articles, DX-peditions, antennas, mobile, awards, computer related accomplishments, telemetry analysis, a description of A-O-D etc. G3ZCZ and I can provide pictures and editorial help to you. If you are willing to assist in this part of the fund raising program by writing an article, please drop us a card. Thanks.

Gary, W3HUC

AMSAT GRATEFULLY ACKNOWLEDGES DONATIONS OF $100.00 OR MORE FROM THE FOLLOWING NEW LIFE MEMBERS:

LM-545 Lawrence Koziel, WB8MUS
LM-546 Russell C. Scott, KL7SHM/W7SHM
LM-547 Ernest L. Lindquist, WA7LRP
LM-548 Michel Marcel, F1ABN
LM-549 Karl A. Emrich, WA4SBC
LM-550 William A. Lueth,Jr, W9AI
LM-551 W.D. "Bill" Hudgins, W4YY
LM-553 Richard A. Ahrens, W3WJC
LM-554 Dennis R. Barth, K7DYH
LM-555 Dana A. Whitlow, K8YUM

AMSAT GRATEFULLY ACKNOWLEDGES DONATIONS FROM THE FOLLOWING NEW LIFE MEMBER SOCIETY:

LMS-21 Columbus Amateur Radio Association, Inc., W8TO, Columbus, Ohio

AMSAT Treasurer's Report For Third Quarter of 1976

ASSETS:	June 30, 1976		$ 54,249.88
RECEIPTS:	Dues (Note 1)	$ 2,145.10	
	Donations (Note 2)	1,081.50	
	Interest	645.46	
	Other Income (Note 3)	1,283.75	
	Total		$ 5,155.81
EXPENSES:	Postage and Shipping	439.64	
	Office Supplies	214.11	
	Telephone	309.20	
	Printing	1,067.10	
	Photography	26.34	
	Typing	110.20	
	Travel	203.51	
	Command Stations	100.00	
	Capital Equipment	--	
	Components	318.50	
	Salaries and FICA	3,776.72	
	Unemployment Insurance	19.94	
	Miscellaneous	34.05	
	Total		$ 6,619.31
EXCESS OF EXPENSES OVER INCOME:			$ 1,463.50
ASSETS:	Sept. 30, 1976		
	General Checking Account	$ 3,324.79	
	Payroll Checking Account	415.17	
	General Savings Account	43,125.01	
	Liquid Assets Fund	5,484.61	
	Payroll Savings Account	436.80	
	Total Assets		$ 52,786.38

Note 1: Dues received from: Individuals, $2,105.10 and Member Societies, $40.00.

Note 2: Donations included $755.00 from individuals and societies applying for life membership.

Note 3: Includes $1,103.00 from sale of Orbit Calendars.

SATELLABE
Sophisticated multiscale circular slide rule orbit predictor as described in the newsletter and 73 Magazine. $7.95pp. Ham Radio, Greenville, NH., 03048.

AMSAT-STICKERS
Gummed glossy ($.03c each) or clear acetate($.04c) pressure sensitive labels. Red AMSAT globe, blue letters. SAMCO, Box 203, Wynantskill; NY,12198. Sam will make a donation to AMSAT based on revenues.

FLORESCENT AMSAT LABELS
Pressure sensitive labels,black letters on red background. 48 for $1.25pp. W7ZC. Dave Middleton, Box 303, Springdale, Utah, 84767.

AMSAT NAME TAGS
2.5"xl.5" name tag. Useful at demonstrations and hamfests. $5.00pp. LLORRY'S, 1852 South Reed St., Lakewood, Colo, 80226 Llorry will make a donation to AMSAT based on sales volume.

AMSAT T SHIRTS
100% polyester. A-O-7 in living colour above the earth and AMSAT logo.$10.00pp. proceeds to AMSAT specify white,blue,bone,yellow and size, s, m, l, xl. WB8MUS 3930 Platt Rd, Ann Arbor, MI,48104.

35mm SLIDE SETS
21 slides for talks and demo's. $5.40pp($7.48 or 40IRC's overseas) K6PGX, Norm Chalfin, Box 463, Pasadena, CA, 91102.

1976 ANNUAL MEETING AND ELECTION

The 1976 AMSAT Annual Meeting was held 23 October 1976, at the NASA Goddard Employees Recreation Center, Greenbelt, Maryland. The following members of the Board of Directors were in the audience of about 80:

Thomas A. Clark, WA3LND
William Dunkerley, WA2INB
Jan King, W3GEY
Perry Klein, W3PK
William A. Tynan, W3KMV/W3XO

Tom Clark opened the meeting at 2015 EDT and welcomed the group on behalf of the host, the Goddard Amateur Radio Club. Perry Klein presented the AMSAT Annual Report, copies of which were distributed. He also presented the Financial Report and noted the need for a fund-raising campaign.

Harry Yoneda, JA1ANG, representing JAMSAT (Japan), presented a report on the progress of his group. They are an active group of about 100, and he was able to show the prototype 145 to 435 MHz transponder which they operated from Mount Fuji.

Jan King, W3GEY, reported on the present status of OSCARs 6 and 7, and the progress toward Phase III and the interim A-O-D. A-O-D has a launch opportunity in June 1977, and will be a simple satellite of the Phase II style with 2 to 10, and possibly 2 to 435 transponder(s). He then presented slides showing the progress of Phase III.

Rich Zwirko, K1HTV, gave an operations summary and plans for the coming year's operation of OSCAR 6 and 7. He stressed the need for users of OSCAR 7 mode B to keep power down to avoid excessive transponder current drain.

Tom Clark, WA3LND, reported on the demonstration in connection with the opening of the Air and Space Museum of the Smithsonian Institution, and played a tape of the U.S. President as received through OSCAR.

Joel Kleinman gave a report on the ARRL Educational Program as it concerned AMSAT. He gave figures on educator participation. He also had a number of preproduction copies of the ARRL OSCAR locator which were given away.

The results of the election were announced by Stephen Culp, K8QKY, who served as chief teller. The three nominees receiving the largest number of votes were elected to the Board,

Thomas A. Clark, WA3LND/WØIUF	83
Richard Zwirko, K1HTV	57
Patrick J. A. Gowen, G3IOR	41
- -	
William I Dunkerley, WA2INB	36
Joe Kasser, G3ZCZ/W3	36
John C. Fox, WØLER	30
William J. Webster, Jr.	30
Larry Kayser, VE3QB/WA3ZIA	25*

*Mr. Kayser had requested that his nomination be withdrawn, but many of the mail ballots were received before his request was made known.

Perry Klein presented a list of activities in which AMSAT needs volunteer help. First on the list was A-O-D construction. Coordination meetings are held each 2nd Wednesday at 8 pm in the NASA Goddard Bldg. 2 conference room. He also called for Mode B bulletin stations; JA1ANG volunteered to handle the Far East. Other fields where help is needed are computer tape interchange standards, operations planning for Phase III, translation of informational material, etc.

Will Webster spoke on Net activities and announced that a local net will be held on the AMSAT 85 repeater each Tuesday about an hour before the regular 75-meter net (in the Washingon DC. area...Editor).

The meeting adjourned at 2240 EDT.

Respectfully submitted,

Robert J. Carpenter, W3OTC
Secretary

AMSAT NETS

The following AMSAT Nets meet regularly to disseminate information to newcomers and to keep regular satellite users in communcation with one another.

USA-East Coast Net	Wednesdays	0100 Z	3850kHz LSB	Net Control W3ZM or W3UN
USA-Mid States Net	Wednesdays	0200 Z	3850kHz LSB	Net Control WØCY
USA-West Coast Net	Wednesdays	0300 Z	3850kHz LSB	Net Control W6CG
JA-Net	Mondays	1300 Z	3555kHz LSB	Net Control JA1ANG
Asia-Pacific Net	Sundays	1100 Z	14,280kHz USB	Net Control JA1ANG
Western Europe Net	Sundays	1000 Local	3780kHz LSB	Net Control G3RWL
	Sundays	1100 Local	7060kHz LSB	Net Control G3RWL
International Net	Sundays	1800 Z	14,280kHz USB	Net Control W3ZM or W3UN
	Sundays	1900 Z	21,280kHz USB	Net Control W3ZM or W3UN
Africa-Europe Net	Sundays	1700 Z	14,280kHz USB	Net Control G3IOR
	Saturdays	1000 Z	14,280kHz USB	Net Control G3IOR
Africa Net	Saturdays	1100 Z	14,280kHz USB	Net Control TU2EF
	Saturdays	1130 Z	21,280kHz USB	Net Control TU2EF

The following vhf frequencies are also in Use:

London, England	144.28MHz USB	Net Control G8CSI	Sundays	1930 Local
Atlanta, Georgia	145.80MHz USB/CW	Net Control WA4DDH	Sundays	2000 Local
Washington, D.C.	146.25-85MHz FM	Net Control W3UN	Wednesdays	0200z
Los Angeles, Calif.	146.25-85MHz FM	Net Control W6CG	Daily	

Bulletins of general interest to those interested in amateur satellites are transmitted regularly on OSCAR-6 reference orbits, at approximately 10 minutes after Ascending Node. These bulletins are transmitted on a Downlink Frequency of approximately 29,490 kHz and can be received over most of Eastern North America.

Educational bulletins are transmitted regularly by AMSAT Educational Bulletin Stations in North America on even numbered weekdays of the year via the AMSAT-OSCAR 6 two-to-ten meter transponder. These bulletins, addressed to schools, can be heard on 29.50 MHz during morning passes having equatorial crossings between 250 and 305 degrees W. Longitude.

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